

A new species of *Lampromyia* Macquart, from Oman: the first record of Vermileonidae (Diptera) from the Arabian Peninsula

by

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ABSTRACT

A description is given of *Lampromyia umbraticola* sp. n., discovered in the Hajar Mountains of northern Oman. This distinctive species is phylogenetically isolated and constitutes a monospecific species-group. The wide but fragmented range of *Lampromyia* Macquart, 1835, suggests that this genus is a relict of an old African fauna, and that it was distributed across the Saharan and Arabian areas before their aridification.

INTRODUCTION

No published records exist of Vermileonidae in the Arabian Peninsula. The closest occurrences involve species of the genus *Vermileo* Macquart, 1834, which have been recorded in the Levant, Egypt and the Sudan (Bezzi 1909; H. C. Efflatoun, in Wheeler 1930; Edwards 1935; Hafez & El-Moursy 1956a,b 1964). This genus otherwise has a wide distribution through the European countries bordering the Mediterranean, from Yugoslavia to Iberia. It is also known from the islands of Crete (Stuckenberg 1965), the Balearics (Wheeler 1930), and Malta (specimens seen by BRS), and an Algerian specimen representing an undescribed species has been identified (by BRS). *Vermileo* thus appears to be a palaearctic element that spread into Africa at both the eastern and western extremities of the Mediterranean.

The vermilionid described here was discovered in the Hajar Mountains of Oman (by MF). It is a member of the genus *Lampromyia* Macquart, 1835, which was revised recently by Stuckenberg (Southern African species, 1996; palaearctic species, 1998). *Lampromyia* is a component of a major monophyletic clade of genera which evolved and diversified in Africa. Most of these genera – *Vermipardus* Stuckenberg, 1960, *Vermilynx* Stuckenberg, 1995a, and *Leptynoma* Westwood, 1876 (with two subgenera) – are restricted to Southern Africa. *Lampromyia*, however, has been biogeographically exceptional in being constituted by widely disjunct species-groups: the *pilosula* group of South Africa and Zimbabwe; the *canariensis* group of the Canary Islands; and the *cylindrica* group, mainly of north-western Africa, with two vicariant offshoots in Iberia, one of which also occurs in France (Stuckenberg 1998). This new Arabian species constitutes another species-group, and provides a significant extension of the known range of the genus.

The presence of *Lampromyia* in Oman was unexpected, as the genus has never been recorded in East Africa where much collecting has been done. This discovery accords with conclusions derived in recent synoptic studies of the biogeography of various insects groups in Arabia – notably the butterflies by Larsen (1984), and the Neuroptera by Hölzel (1998) – that northern Oman, where the Hajar Mountains are located, can be categorised as the easternmost limit of the Afrotropical Region. The existence of the Omani species indicates that *Lampromyia* probably occurs in Yemen, and possibly in the Somali Arid Zone of Africa. Perhaps species even survive as relicts in any massifs scattered across the Sahara that still retain enough food resources of flowering plants for the flies and small terrestrial prey (such as ants) for the larvae.

MATERIAL AND METHODS

The specimens are pinned flies, except for one paratype preserved in ethanol; all are in the Natal Museum Diptera Collection. Terminology used for male genitalic structures follows previous publications (Stuckenberg 1995b 1996 1998); the *synsternite* (sn) is the compound structure resulting from fusion of the gonocoxites with one another and (probably) the hypandrium; the *dorsal bridge* (db) is a transverse sclerotisation joining the dorsobasal edges of the gonocoxites, to which the aedeagus is attached; the *ventral aperture* (va) is a distal, ventromedian gap in the synsternite; T = tergite. Terminology of antennal components follows proposals by Stuckenberg (1999). Sclerotised genitalic structures were macerated in hot KOH, and drawn with Zeiss equipment while mounted in glycerine jelly. Wing length was measured from the distal end of the basicostal scale to the apex of the wing.

TAXONOMY

Genus *Lampromyia* Macquart, 1835

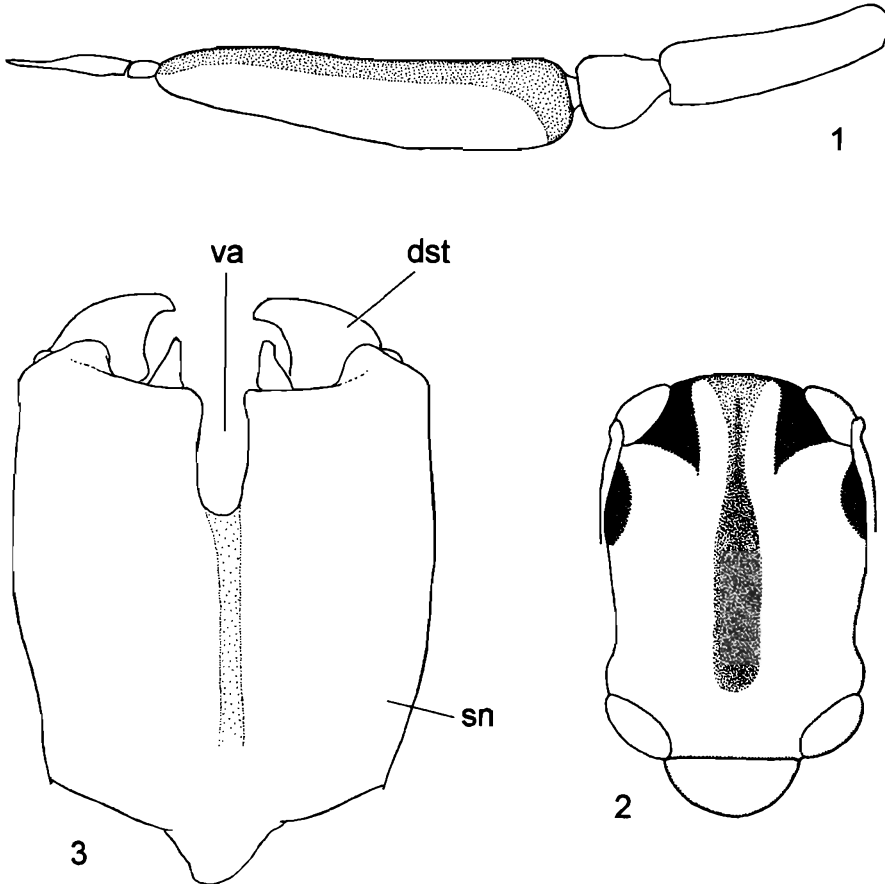
Lampromyia Macquart, 1835; type species *Lampromyia pallida* Macquart, 1835.

A new and more restricted definition of this genus resulted from cladistic studies by Stuckenberg (1996 1998). *Lampromyia* now comprises species with the following features:

1. Proboscis elongate and slender through lengthening of the prementum, 2.5–4.5 x mesonotal length, capable of oblique posterior reflexion between the legs and forward extension for feeding at flowers.
2. Face protruding (this condition linked to proboscis elongation).
3. Labella in form of elongate, dorsoventrally somewhat flattened tubes, separated over their entire length though held together in life; each labellum contains only a single elongate pseudotrachea which is bifid.
4. Antennal postpedicel enlarged, with from three to six fused flagellomeres (most palaearctic species with six fused, as in Fig. 1); stylus with slender, elongate apical segment, and short, narrow, cylindrical pre-apical segment.
5. Wing with only moderate petiolation basally.

The diagnostic synapomorphy of *Lampromyia* species is the bifid condition of the single pseudotrachea in each labellum. In the genera confined to Southern Africa (except *Vermipardus*, which has entirely different labellar modifications), the

pseudotrachea is trifid (Stuckenberg 1996, Figs 10, 11). The identity of the Omani species as belonging to *Lampromyia* is confirmed by its bifid pseudotracheae.



Figs 1–3. *Lampromyia umbraticola* sp. n. 1. Antenna; the area on the postpedicel densely covered by sensory vestiture is represented by stippling. 2. Mesonotal pattern. 3. Synsternite, ventral view.

In previous characterisations of *Lampromyia*, it was stated that the hind tibia is more slender apically than the hind femur; this is a common condition in Diptera and is the plesiomorphic state. Species of the related genera *Leptynoma* and *Vermilynx* have the hind tibia markedly swollen apically, as much as the femur, this being an apomorphic condition which contributes to the characteristic appearance of the flies. The new species described below has the hind tibia in both sexes conspicuously thickened apically, and even more swollen than the hind femur; this character state is thus homoplastic with *Leptynoma* and *Vermilynx*.

***Lampromyia umbraticola* sp. n.**

Figs 1–9

Etymology: *umbraticola* (L.), shade-dwelling, referring to the preference of the larvae for constantly shaded, protected sites.

Material examined: Holotype ♂; paratypes – three ♀ and one ♂: OMAN, Western Hajar Mountains, slopes of Jebel Shams, c. 2400 m, 23°14.0'N, 57°14.9'E; collected as larvae by M. Fisher, 24 January 1998, from dusty overhang in wadi on regular walking route from camp near edge of canyon to ridge at 3000 m. Paratype reared in Oman by M. Fisher. Larvae reared in KwaZulu-Natal by B. R. Stuckenberg produced flies on the following dates: holotype ♂ 17.xii.98, paratypes ♀ 1.iv.98, ♀ 23.xii.98, ♀ 6.i.99. Natal Museum Type no. 2201. Paratype genitalia in glycerine in microvial on pin; paratype ♂ and one ♀ partly dissected – wings, labella and antenna mounted in balsam, body of ♂ preserved in ethanol, ♀ abdomen in glycerine in microvial on pin.

Diagnostic features: Medium-sized, glossy, amber yellowish- or orange-brown species with darkly banded abdomen and distinctive mesonotal pattern; fore and middle legs amber yellowish-brown, hind legs contrastingly dark; antennal postpedicel elongate, stylus very short; venation distinguished by narrow radial fork, presence of m-cu crossvein, shortness of radial-sector, and other character-states described below; T8 exposed, of normal form; epandrium short, not projecting, unspecialised; aedeagus without lateral extensions; spermatheca subovoid, with membranous sac emerging from distal aperture.

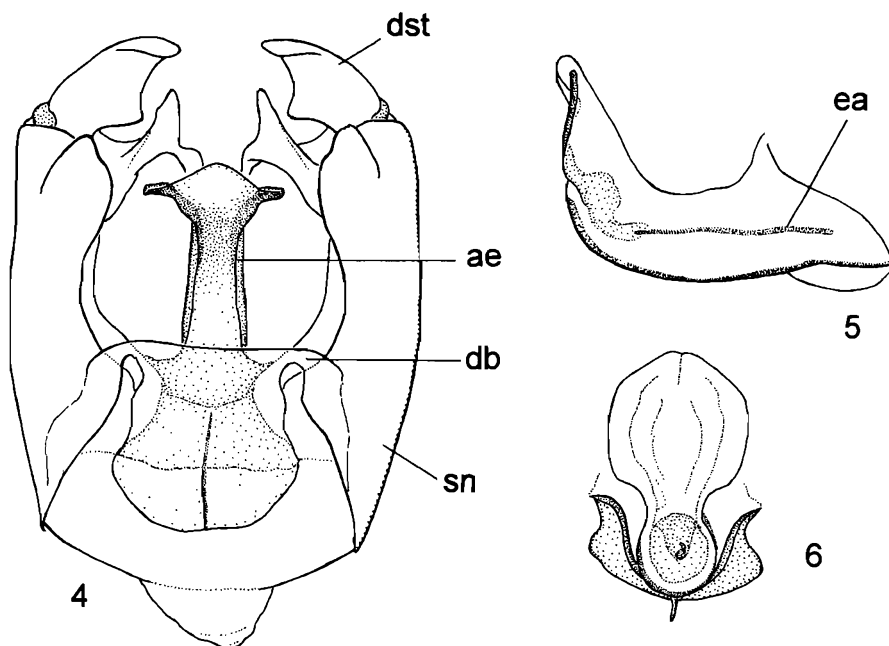
Holotype ♂:

Head: Frons approximately square, about one-fifth of head width, dark greyish pruinose, depressed in midline. Antenna (Fig. 1) elongate, flagellomeres 1–6 fused into postpedicel; scape elongate cylindrical, about 4 x as long as deep, pale yellowish-brown; pedicel moderately swollen apically, about 40 % of length of scape, brownish; postpedicel very elongate, a little less than twice length of scape, narrowing distally due to gradual convergence of ventral margin, dark brownish; stylus short, dark brown, densely microsetose, slightly longer than one-third of postpedicel, basal stylomere (segment 9) less than one-quarter of apical stylomere (proportionate lengths 6:29). Postpedicel exceptional in having a dense, sharply-demarcated vestiture of anteriorly-directed, semi-recumbent sensilla on dorsal and dorsolateral surfaces, these sensilla mostly minute, stout, setiform, intermixed with some sensilla basiconica in conspicuous pits. Face pale amber-yellow, protruding and undulant in profile; proboscis about 3.1 x mesonotal length, slender, shining blackish, a clearly defined whitish section posteriorly over a little less than basal quarter. Ocellar tubercle shining black; occiput with black median mark from tubercle to cervix, narrowing away from tubercle, then expanding above cervix; upper occiput with velvet-black markings along eye margins, broadening subtriangularly on each side of raised median extension of tubercle and descending towards cervix, very narrowly separated from median mark by thin lines of golden-brown pruinescence; remainder of occiput shining greyish pruinose with shifting, variable, brownish tinting, and shining silvery and golden hairs.

Thorax: Glossy amber yellowish-brown, including all coxae, fore and middle legs, scutellum and postnotum; mesonotum (Fig. 2) more strongly brown, boldly marked with dark median vitta which is rounded posteriorly and terminates between wing bases, anteriorly this vitta narrowing abruptly into a slender midline mark extending to anterior mesonotal margin; a conspicuous, subtriangular, blackish mark anteriorly between

humeral callus and raised median area over which vitta lies; a conspicuous, blackish, subovoid mark laterally in notopleural area before transverse suture. Scutellum flat, unmarked. Pleura quite strongly brownish over mesopleuron, more weakly suffused with brown over sterno- and meta-pleura. Fore and middle tarsi progressively darkened apically; hind legs conspicuously darkened, femur and tibia obscurely paler dorsally over short middle section, tibia dull tawny over very short basal section, metatarsus dull, dark brownish, remaining tarsomeres more darkly brown.

Wing (Fig. 7): Moderately petiolate, petiole about one-sixth of total wing length; leading edge almost straight, apex rounded; anal lobe narrowing basally, its greatest transverse diameter slightly longer than greatest transverse diameter of anal cell. R_{2+3} only slightly arched basally, gradually curved forwards apically, its point of origin unusually close to base of radial-sector; length of R_5 about one-half length of basal section (to r-m crossvein) of R_{4+5} , radial-sector with narrow break near mid-length; fork of R_4 and R_5 relatively deep, unusually narrow, diverging only moderately, length of R_5 about 90 % of length of R_{4+5} measured from r-m intersection; R_4 with short basal section separating from R_5 at almost a right-angle, then sharply bent, in some wings a very short stump at this angle, long apical section of R_4 only slightly curved forwards; cell m_3 open; m-cu crossvein present; anal cell open. Veins dark brown; membrane mostly pale smoky-grey, brownish tinged in costal and subcostal cells, basal cells slightly paler; weak pale strips within other cells; no definite stigma or other pattern, except a narrow, dark strip bordering R_1 posteriorly along its apical section, and a diffuse brownish area in first basal cell bordering radial-sector. (Wing colouring in holotype probably not fully developed; see description of ♀ wing below).



Figs 4-6. *Lampromyia umbraticola* sp. n. 4. Synsternite, dorsal view. 5. Aedeagus, lateral view. 6. Aedeagus, posterior view.

Abdomen: Strongly petiolate over segments 2–6; T1 unicolorous with coxae; T2, T3 and T4 each somewhat reddish yellowish-brown over a little more than basal half, these tergites distally with prominent, blackish-brown band not reaching hind margin which is narrowly bordered with yellowish-brown; on T5 the basal pale section occupies about one-third of tergal length, remainder light brownish; T6–8 and epandrium uniformly brownish. T1 with small, sparse, dark hairs; T2–5 with abundant, stiff, blackish-brown, semi-recumbent hairs over dark distal bands, the area covered by these hairs increasing in length on each succeeding tergite and strengthening the banded appearance of abdomen as the hairs are absent over yellowish-brown basal portions; these hairs unusual in being laterally flattened, resembling, slender, sharp daggers; unicolorous T6–8 and epandrium entirely covered by such hairs.

Hypopygium (Figs 3–6): Relatively inconspicuous because of short epandrium; T8 short, exposed and not medially narrowed. Epandrium strongly transverse in dorsal view, anterior and posterior margins shallowly concave, lateral margins in profile with moderate basal incurvature; in posterior view, epandrium is seen to be transversely arched with incurved flanges partly enclosing median aperture through which cerci project. Synsternite (sn) with small, narrow, subrectangular ventral aperture (va), distal margin on each side of aperture transverse, an elongate, narrow, weakly sclerotised strip in midline extending basally from proximal end of ventral aperture; dorsal margins of synsternite undulant, projecting posteriorly as irregularly rounded, setose lobes; dorsal bridge (db) of simple transverse form; paired irregularly subtriangular, setose projections situated inward of gonostyles; gonostyles (gs) short, broad, incurved, with short, stout apical point. Aedeagus (ae) short, lacking lateral projections, with small, rounded ventrobasal keel; strongly upcurved over apical section which is transversely flattened and broadened; ejaculatory apodeme (ea) unusually elongate, slender, almost rod-like.

Measurements: Wing length 7.5 mm; proboscis 5.3 mm; mesonotum 1.7 mm.

Paratypes ♀ ♀ :

Colouring and patterning: Head, thorax, fore and middle legs as in ♂, but colouring more orange-brown; hind legs dark, femur with strongly defined, contrasting, yellowish-brown section starting at about mid-length and terminating to leave apical one-fifth of femur dark; on outer surface of femur a narrow dark line runs across this pale section and joins apical and basal dark sections.

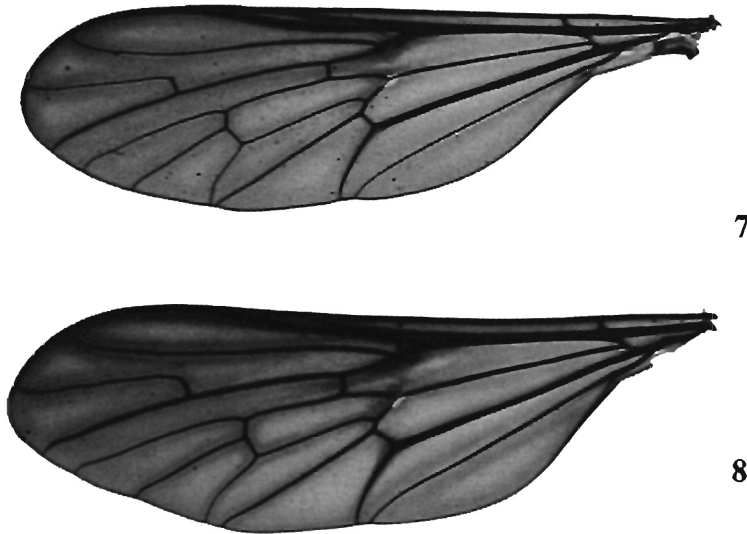
Wing (Fig. 8): Colouring variable, probably correlated with age at time of death; veins dark brown, membrane shining, strongly smoky-grey except in basal cells, most of discal cell, and basal half of cell r_{2+3} , which are slightly yellowish brown; costal and subcostal cells, and basal part of cell r_1 more strongly dull yellowish-brown; pale, faintly greyish areas within radial cells. No stigma or other patterning, apart from dark brownish area in apex of first basal cell, bordering radial-sector posteriorly, and a narrow, dark brown border posteriorly along R_1 apical to junction with radial-sector.

Abdomen: Strongly banded; T1 unicolorous, T2–4 with blackish pre-apical bands, these shorter than in ♂, narrowly separated from hind margins by yellowish borders;

T5 similar to T4 but dark band shorter and not as intense, poorly defined; T6 and T7 almost unicolorous. Tergites with the same dark, stiff, laterally-flattened hairs as in ♂, covering more or less apical half of T2–5, all of T6 except a narrow basal strip, and all of T7 and T8.

Spermathecae (Fig. 9): Three in segment 7, brown; not constant in shape, two being irregularly ovoid as figured, with short, proximal constriction before emergence of pale, transparent duct; third one irregularly short-fusiform; each spermatheca has a distal aperture from which an apically rounded, transparent, membranous sac protrudes; externally the spermathecal wall is slightly and irregularly ridged.

Measurements: ♀ wing length 9.0 mm, proboscis 6.0 mm, mesonotum 2.2 mm; ♀ wing length 8.7 mm, proboscis 5.6 mm, mesonotum 2.0 mm; ♀ wing length 9.0 mm, proboscis 5.3 mm, mesonotum 2.1 mm.



Figs 7–8. *Lampromyia umbraticola* sp. n. 7. Male wing. 8. Female wing.

GENERAL HABITAT DESCRIPTION

Larvae were found in fine dusty sediment on the floor of deeply shaded rock overhangs, caves and deserted houses, at altitudes of 1800–2500 m, in the arid to semi-arid Hajar Mountains of Northern Oman, in areas that receive a mean annual rainfall of 150–350 mm per year (Fisher & Membery 1998). Larvae occur only in locations which rarely or never receive direct sunlight and are mostly or permanently sheltered from rainfall. Rock overhangs which contain the preferred substrate but which are sufficiently exposed to receive sun and/or occasional rainfall were never found to contain the larvae. Larvae may be expected to occur up to the highest altitudes of the Hajar Mountains (3000 m), though observations were not made above 2500 m. The larvae were not found lower than c. 1800 m, and may not be found much below this altitude as they appear to be sensitive to high temperatures.

Occasionally antlions (*Myrmeleon hyalinus* Olivier and *Myrmeleon* sp.) and, more

infrequently, unidentified nemopterid larvae, were found closely associated in the same locations. The wormlions are quite common in both the western and eastern Hajar Mountains, but only within their preferred habitat, which is limited in extent and exceedingly small in area. The flies have not been collected in the wild; specimens were bred out in the laboratory (by MF) following daily feeding with ants.

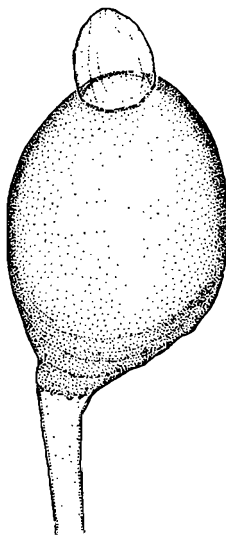


Fig. 9. *Lampromyia umbraticola* sp. n. Spermatheca.

RELATIONSHIPS AND BIOGEOGRAPHY

This new species of *Lampromyia* is not only distinctive in appearance, but also is exceptional in the following features which suggest it to be phylogenetically isolated:

- Wing venation (Figs 7–8): moderate curvature of R_{2+3} ; almost straight alignment of R_{4+5} and R_5 ; deep, narrow fork of R_4 and R_5 ; almost straight form of R_4 distal to its basal flexure; open anal cell and cell m_3 ; presence of m-cu crossvein (CuA_1 not confluent with discal cell); shortness of radial-sector (most unusual in African vermilionids for radial-sector to be shorter than basal section of R_{4+5}). These features give the wing of *umbraticola* a relatively primitive character.
- Antennal form (Fig. 1): extreme elongation of postpedicel, together with very short style; also, the well-defined, dense, dorsal vestiture of minute sensilla chaetica mixed with sensilla basiconica, on the postpedicel.
- Ejaculatory apodeme (Fig. 5, ea): a very elongate, slender and almost straight rod (relatively much shorter and irregularly bent in other species).
- Spermatheca (Fig. 9): unique in having a circular *distal* aperture, through which a membranous sac protrudes. The only comparable condition occurs in the species of the *cylindrica* subgroup (as in *L. lecerfi* Séguy, see Stuckenberg 1998, Fig. 12), but it differs fundamentally in having the sac protruding from a large *proximal* aperture and the duct arising from this sac.
- The form of the aedeagus is also notable. In species of *Leptynoma*, *Vermilynx*,

and the *pilosula* and *canariensis* groups of *Lampromyia*, the aedeagus has paired lateral extensions, resulting in a trifold form. Species of the *cylindrica* group (illustrated by Stuckenberg 1998) have such lateral arms absent (*L. cylindrica* (Fabricius), *L. iberica* Stuckenberg), or represented possibly by flanges protruding on each side of the middle section of the aedeagus (*L. funebris* Dufour, *L. pallida* Macquart). Because the trifold condition is widespread, the lack of lateral extensions was interpreted as a reversal. In *umbraticola* the aedeagus (Fig. 5) similarly has no lateral extensions, but probably through homoplasy as this species lacks two important apomorphies of the *cylindrica* group: the modified T8 of the male, and the greatly enlarged, posteriorly extended epandrium, with correspondingly elongate proctiger.

Analysis of relationships following the cladistic study by Stuckenberg (1998) produces the following result:

1. This new species lacks the apomorphic form of dorsal bridge in the hypopygium and form of the spermatheca characteristic of the *pilosula* group in Southern Africa.
2. It lacks the highly apomorphic condition of T8 of the male abdomen, which establishes monophyly of a clade formed by the *canariensis* + *cylindrica* species-groups.

On present knowledge, *umbraticola* therefore constitutes a species-group by itself. *Lampromyia* is now seen to be composed of three geographically disjunct lineages: the disparate *pilosula* and *umbraticola* groups, and the clade formed by the *canariensis* + *cylindrica* groups – a trichotomy at present unresolved.

The discovery of *umbraticola* supports the conclusion of Stuckenberg (1998) that *Lampromyia* is a relict genus from an earlier African fauna that existed before aridification of the Saharan zone and Arabia, and before faunal exchange with southwestern Europe and Asia Minor established the present biological features of palaearctic Africa and the transition to the Afrotropical Region. The occurrence of *Lampromyia* in southeastern Arabia and of *Vermileo* in the Levant and Egypt is further evidence that there never was direct contact in this region between the palaearctic and afrotropical faunas since closure of the eastern Mediterranean in the Miocene (Larsen 1984).

ACKNOWLEDGEMENTS

The Director of the Natal Museum, Dr Jason Londt, and the Head of the Department of Arthropoda, Dr David Barraclough, are thanked by Brian Stuckenberg for their ongoing support of his research. Thanks from Martin Fisher are due to Drew Gardner for his companionship on the many excursions that led to the discovery of this species.

REFERENCES

- BEZZI, M. 1909. Diptera syriaca et aegyptica a cl. P. Beraud S. J. collecta. *Broteria: Serie Zoologica* **8**: 37–67.
- EDWARDS, F. W. 1935. "Worm-lions" from Portugal and the Sudan (Diptera, Rhagionidae), with a description of a new species. *Proceedings of the Royal Entomological Society of London* **10** (2): 54–57.
- FISHER, M. & MEMBERY, D. A. 1998. *Climate*. In: Ghazanfar, S. A. & Fisher, M., eds, *Vegetation of the Arabian Peninsula*. The Netherlands: Kluwer Academic pp. 5–38.
- HAFEZ, M. & EL-MOURSY, A. A. 1956a. Studies on desert insects in Egypt. I. Field and laboratory

- investigations on the worm-lion, *Vermileo vermileo* L. (Diptera: Rhagionidae). *Bulletin. Société Entomologique d'Égypte* **40**: 279–299.
- 1956b. Studies on desert insects in Egypt. II. On the general biology of *Vermileo vermileo* L. (Diptera: Rhagionidae). *Bulletin. Société Entomologique d'Égypte* **40**: 333–348.
- 1964. Comparative notes on the habits of the pit-building worm-lions (Diptera: Rhagionidae-Vermileoninae) and ant-lions (Neuroptera: Myrmeleonidae). *Bulletin. Société Entomologique d'Égypte* **47**: 125–132.
- HÖLZEL, H. 1998. Zoogeographical features of Neuroptera of the Arabian peninsula. *Acta Zoologica Fennica* **209**: 129–140.
- LARSEN, T. B. 1984. The zoogeographical composition and distribution of the Arabian butterflies (Lepidoptera; Rhopalocera). *Journal of Biogeography* **11**: 119–158.
- STUCKENBERG, B. R. 1965. Notes on the palaearctic species of *Vermileo*, with the description of a new species from Crete (Diptera: Rhagionidae). *Annals and Magazine of Natural History* (Ser. 13) **8**: 495–500.
- 1995a. *Vermilyn*, a new genus for the wormlion fly *Lampromyia vansonii* Stuckenberg of the Richtersveld, southern Africa (Diptera: Vermileonidae). *African Entomology* **3**: 29–34.
- 1995b. A taxonomic revision of *Vermipardus* Stuckenberg, 1960, with descriptions of new species and notes on the biology and biogeography of the genus (Diptera: Vermileonidae). *Annals of the Natal Museum* **36**: 215–253.
- 1996. A revised generic classification of the wormlion flies of Southern Africa previously placed in *Lampromyia* Macquart, with reinstatement of *Leptynomia* Westwood, 1876, and descriptions of a new subgenus and two new species (Diptera: Vermileonidae). *Annals of the Natal Museum* **37**: 239–266.
- 1998. A revision of the Palaearctic species of *Lampromyia* Macquart (Diptera, Vermileonidae), with the description of a new Iberian species and a cladogram for the genus. *Bonner Zoologische Beiträge* **48**: 67–96.
- 1999. Antennal evolution in the Brachycera (Diptera), with a reassessment of terminology relating to the flagellum. *Studia Dipterologica* **6** (1): 33–48.
- WHEELER, W. M. 1930. *Demons of the dust*. London: Kegan Paul, Trench, Trubner & Co., Ltd.